

A photograph of a forest path covered in a thick layer of green leaf litter. The path is narrow and curves through the forest. The trees are tall and thin, with some moss on their trunks. The sky is visible through the canopy.

FROM SCIENTIST TO PRODUCER



Eesti Maaülikool
Estonian University of Life Sciences

www.emu.ee

ESTONIA – liveable and everlasting

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Cover photo by **Arne Ader**
Ramsons. At the EMÜ Puhtulaiu field station

FROM SCIENTIST TO PRODUCER

- How to restore a park or an old mansion?
- Is it possible to grow grapes in your own garden?
- Should you plant birch-trees in a fallow field?
- How to restore an old mill inherited from your Grandpa?
- Is the pond behind the sauna at our farm suitable for breeding carps?

The researchers at the Eesti Maaülikool (Estonian University of Life Sciences) are sure to know the answers to these five questions. The scientists of the EMU are bound to know answers to many other questions as well. You can find such questions by the dozen in the present booklet.

On the other hand, we would like to draw your attention to the know-how at our University and show where the disciplines fostered here are heading to.

The booklet includes a list of themes for applied research and development. The themes break up into eight groups: plant, animal, forest, environmental, economic, construction, energetic and technological science.

We are gladly ready to help the farmer, entrepreneur or local government.

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LABORATORY ANALYSIS OF SOIL AND PLANT, ADVICE FOR THE INTERPRETATION OF THE RESULTS

Keywords: field crop husbandry, horticulture, forestry, greenery, scientific research

We offer services and know-how:

- chemical analysis of soil, peat and organic manure;
- laboratory analysis of the physical parameters of soil;
- chemical analysis of plant material;
- counselling for the application of the results of the analyses.

Analyses are made both for carrying out scientific research and for giving practical managing advice.

Based on the analyses of the chemical and physical parameters of soil we offer counselling for example for:

- compiling fertilisation plans;
- assessing soil suitability and
- planning land use.

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CULTIVARS, FERTILIZATION, POSTHARVEST, BIOCHEMICAL COMPOSITION OF THE HORTICULTURAL CROPS

Keywords: producers and processors of horticultural crops, producers of input materials (fertilizers, mulches etc.)

Agrotechnological experiments with new cultivars. The aim of the fertilization experiments is to enable to optimise plant nutrition.

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GROWING STONE FRUITS

Keywords: commercial orchard owners, farmers, hobby gardeners

Counselling service for growing plums and cherries.

We present new plum and cherry cultivars, advise on cultivar selection, help to find compatible pollination partners for fruit trees that are not self-fertile, and advise our clients in the solution of any difficulties in connection with the conventional and organic growing of stone fruits.

Our service will enable to reduce several risks that often associate with the growing of stone fruits and try to encourage the growers to practise with these crops.

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GOOD ESTONIAN FRUITS AND BERRIES

Keywords: commercial orchard owners, garden owners

Counselling service for growing new fruit and berry cultivars. Specialist advice helps commercial orchard owners to select the best cultivars for their gardens.

In addition it is possible to conclude contracts for growing planting material.

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PROCESSING AND PRODUCT DEVELOPMENT OF PLANT ORIGIN RAW MATERIAL

Keywords: processing, bioactive compounds, functional food, natural cosmetics and plant protection products, producers and manufacturers of plant origin raw material.

Services of product development and pilot-scale processing to launch high value-added food and non-food products. Biochemical analyses of raw material and products, nutritional value, packaging and labelling of products. Support and advice of applying the business grants.

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ORGANIC BEEKEEPING AND POLLINATION

Keywords: nature conservation board, farmers, tourism, beekeepers, schools, kindergartens

Training and counselling for:

- the foundation of organic apiary;
- using honey bees, bumble bees and solitary bees to increase the efficiency of crop pollination;
- using honey bee and bumble bee colonies for pollination in greenhouse conditions;
- promoting the abundance of bumble bees and solitary bees in farmland to improve the pollination of crops;
- conservation of bumble bee species;
- using honey bee and bumble bee commercial hives as teaching material in outdoor studies at schools and tourism farms.

The offered knowledge will help to increase the yields and quality of the entomophilic crops (e.g. Fabaceae and Crucifera), fruits and berries.

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IDENTIFICATION OF PLANT PESTS IN DIFFERENT CULTURES (HORTICULTURAL AND FIELD CROPS, ORNAMENTAL TREES AND SHRUBS)

Keywords: counselling services for farmers and horticultural companies, societies and private persons

Counselling. We provide high-quality know-how on pests identification and their biology.

Recommendations for pests control (plant extracts, botanical and synthetical insecticides).

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DIAGNOSING OF PLANT DISEASES OF HORTICULTURAL AND FIELD CROPS

Keywords: organic and conventional growers, plant protection and plant cultivation advisors

Observation field trials for late blight foliar resistance evaluation.

Counselling. We provide high-quality know-how for pathogen **diagnosing**, and for the development and distribution of pathogen epidemiology on main horticultural and field crops.

Suggestions for disease control (integrated pest management).

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WEED CONTROL

Keywords: organic and conventional farmers, advisers

Demo and test trials: herbicides and fungicides of cereals and oilseed rape

Counselling for performing chemical and mechanical weed control, selection of pesticides, optimization of pesticide dosages.

Demonstration and implementation of the Internet based Decision Support System for Integrated Pest Management (I-Taimekaitse).

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GREEN MANURES

Keywords: organic and conventional farmers

Advice for growing green manure crops and the choice of technology (undersowings, pure sowings, catch crops), their impact on the balance of nutrients and humus.

Advice for preparation of crop rotations, incorporating green manures into crop rotations and compilation of humus balance for crop rotations.

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CHEMICAL ANALYSIS OF VOLATILE ORGANIC COMPOUNDS

Keywords: plant breeding, organic farming; air quality at work place

- We study response of plants to stress, which is caused by growth conditions that are different from normal growth conditions such as temperature, humidity, light, CO₂ concentration and/or impact of plant pests (larvae, bacteria, viruses). Plant stress is evaluated by analysing volatile or non-volatile organic compounds stored or released by plant organs in gas chromatograph mass-spectrometry. Samples can be taken while working in the laboratory or on-site.
- We are able to analyse volatiles in indoor air. Based on the results it is possible to evaluate the air quality at work place.
- We offer counselling about plant stress and plant volatiles.
- We carry out projects in collaboration with plant breeders, where we study the impact of fertilizers on plant volatiles which in turn affects the attractiveness of plants towards herbivores.

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Photo: Astrid Kännaste

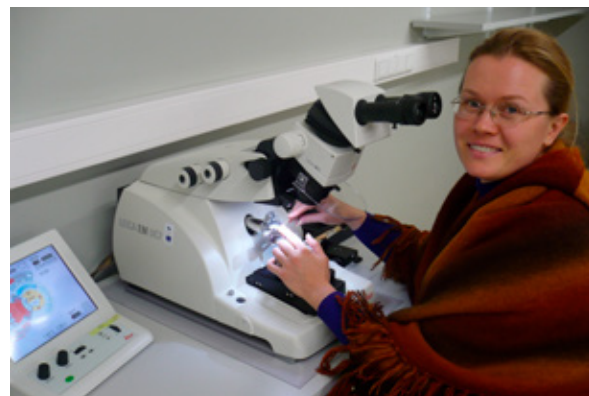
MICROSCOPY SERVICES (FROM PLANT AND OTHER SOFT TISSUES)

Keywords: life sciences, microscopical imaging

- Taking and fixing the samples;
- embedding the sample into resin LR white;
- making semithin (1-2 micrometers) and ultrathin (70-110 nm) sections with ultramicrotome (Leica EM UC7);
- photographing semithin sections under light microscope (Nikon Eclipse 2000);
- photographing ultrathin sections under transmission electron microscope;
- preparing samples for scanning electron microscopy;
- photographing samples under scanning electron microscope.

The service can be helpful for illustrating different (scientific) work and enables making different measurements of small objects.

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FAST-GROWING BROADLEAVES FOR RENEWABLE ENERGY

Keywords: alternative land use and silviculture

Energy forestry technology and counselling:

- for forest owners;
- for land owners.

Alders, birches and aspens are fast-growing and productive tree species.

- Planting is simple and cheap.
- Suitable for afforestation of abandoned fields.
- Alders increase the nitrogen content in soil.

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FOREST PATHOGENS DETECTION AND WOOD QUALITY ESTIMATION

Keywords: determination of disease agents on trees, detection of wood discoloration and rot fungi, molecular diagnostics, forest pathological assessment

We detect pathogens of trees and wood, e.g. agents of wood discoloration and wood rot. We can determine pathogens' agents of the latent phase from seedlings and wood by molecular methods in lab. DNA based detection is used for very similar species or cryptic species determination, these pathogens cannot be detected visually. The latent phase pathogens may later cause significant economic loss in forest, gardens, greeneries, parks, and in wood stores of wood industries.

NB! Please note that imported seedlings may carry dangerous pathogens which cannot be seen visually.

For whom: forest owners, nursery managers, wood industries, greenery managers, arborists.

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DETERMINATION OF WOOD SPECIES AND THEIR PROPERTIES

Keywords: procurement, processing and transport of wood

We give advice and carry out the following laboratory studies:

- determination of wood species of timber or sawn wood;
- testing of properties (density, moisture content, compressive and flexural strength etc) of wood and wood based materials.

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TESTING OF TIMBER BY NON-DESTRUCTIVE METHODS

Keywords: procurement and processing of wood

We give advice and carry out the following laboratory studies:

- testing of physical and mechanical properties of wood by non-destructive testing methods (electrical and ultrasonic);
- development of mathematical models for the non-destructive methods.

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TESTING OF PROPERTIES OF WOOD FUELS

Keywords: procurement, processing, transport and utilization of wood fuels, scientific research

We give advice and carry out the following laboratory studies:

- properties (moisture content, calorific value, ash content, ash fusion etc) of various biofuels;
- analysis of the composition of biofuels.

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ANALYSIS OF RESOURCES OF WOOD FUEL

Keywords: procurement, processing, transport and utilization of wood fuels

We give advice and make analyses of the location of wood fuel resources.

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TECHNOLOGIES OF WOOD RAW MATERIAL PRODUCTION AND PROCESSING

Keywords: procurement, processing and utilization of wood

We give advice and make analyses of:

- technologies of wood procurement;
- technologies of the production of wood fuels;
- wood processing technologies;
- drying of wood;
- methods of the control of wood drying.

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FIELD TRAINING: PRUNING OF GROWING TREES

Keywords: forest management

Objective: dissemination of knowledge about profitability of pruning of growing trees by way of field trainings

Pruning of pole stands increases the value of harvested logs from final felling due to higher price of knot-free timber. Such timber is suitable for the production of premium quality products like furniture, window frames, mouldings etc. Due to pruning the fire hazard of stands is also reduced. During the field training an overview of the techniques and tools for pruning is given and the economic efficiency of pruning is analysed.

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MACHINES AND TECHNOLOGIES FOR SMALL-SCALE FOREST HARVESTING

Keywords: forest management

Objective: dissemination of knowledge about eco-friendly machines and technologies for small-scale forest harvesting, work safety of small-scale forest harvesting by way of organized courses

Utilization of big forest machines for harvesting of small volumes in private forests is often economically not feasible and is not eco-friendly. Felling can be carried out by chainsaw, skidding by horses, ATV, „iron-horse“, mini-forwarders or by farm-tractors. During the course different machines and technologies suitable for small-scale forest harvesting are presented, also work safety issues are discussed.

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CURLY BIRCH CULTIVATION

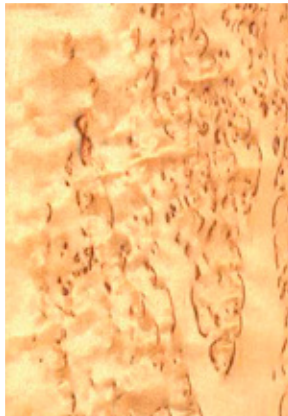
Keywords: alternative land use, forest management

In order to increase the profitability of brushwood and agricultural land with low site quality it is advisable to grow curly birch on former arable and pasture areas. It is relatively fast growing, has short rotation and its wood has high value.

Curly birch's grainy pattern wood belongs to the world's ten most expensive among the precious wood, whereas most of the wood comes from tropical rainforests. Cultivation of curly birch is environmentally friendly as the valuable quality wood originates mainly from culture stands planted on forest lands or former agricultural areas.

We give practical advice on curly birch stand establishment (planting material, habitation selection etc) and maintaining (pruning, thinning, plant protection etc), and we also assist in marketing of the wood. We organize thematic and practical trainings, excursions and offer individual and group counselling.

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ASSESSMENT OF THE SANITARY CONDITION OF TREES AND SHRUBS IN GARDENS, GREENERIES AND FORESTS

Keywords: forest protection, entomology, park management, urban forestry, gardening

Insect pests and fungal diseases may cause large damage to the trees and shrubs in gardens, parks and forests. Undetected pest or fungal pathogen can threaten all stands. It is possible to minimize and relieve the influence and consequences of the damage only by fast discovering and applying proper protection methods.

We assess the sanitary condition of park trees, carry out forest protection expertise and give advice for sanitary improvement of trees.

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MAPPING AND INVENTORY OF WOODLAND KEY HABITATS

Keywords: forest owners

We can map and inventory woodland key habitats and assess the nature value of forest stands.

Woodland key habitat is an area for forest management where probability for habitat of endangered or rare species is higher than usual. To preserve these habitats special management is needed or to stop management completely.

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FOREST AND TIMBER MEASUREMENT

Keywords: nature resource management and nature protection agencies, State Forest Management Centre, real estate companies, nature tourism companies and farms, schools

Counselling, training and practical services for growing forest and roundwood volume estimations, market value estimations and forest management planning. Neutral expert assessments on growing forest and roundwood value assessments for solving disputes between parties.

Counselling and training:

- roundwood volume and quality assessment;
- forest volume measurement and condition assessment;
- roundwood volume assessment by assortments for growing forest;
- market value assessment for forest estate.

Services:

- extracted timber or roundwood volume measurement;
- growing forest volume measurement;
- post cutting stand condition assessment;
- growing forest volume and quality assessment by assortments;
- market value assessment for forest estate;
- geographical mapping of forests, parks and other trees for spatial planning.

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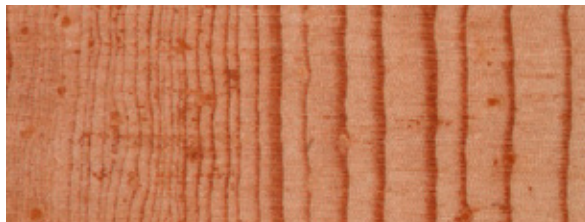
ANALYZING GROWTH TRENDS WITH DENDROCHRONOLOGICAL METHODS

- Composing growth prognoses
- Estimating forest productivity
- Estimating forest nature value
- Dating buildings
- Analyzing disturbances
- Estimating the effectiveness of forest drainage
- Estimating the effect of anthropogenic pollution
- Estimating the effect of thinning

Variability in the structure of tree ring width series gives information about long-term environmental changes during the growing period. By cross-dating, i.e. matching the pattern of wide and narrow tree rings it is possible to find the exact year of formation of each tree ring or to determine the geographic origin of trees. Based on dendrochronological methods (detecting severe growth changes etc) it is possible to reconstruct the stand and stand development including different disturbances (thinning, fire, ditching, insect outbreak etc).

It is possible to study the growth of coniferous and several deciduous species by using tree-ring dating. Tree-ring width measurement data enable to estimate the tree's yearly increment and the stand growth. Based on stand increment data thinning and other management works of stands can be planned.

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SERVICES PROVIDED BY THE CHAIR OF VETERINARY BIOMEDICINE AND POPULATION MEDICINE

- Developing and implementing programmes to control and eradicate animal infectious diseases.
- Epidemiological studies of animal infectious diseases and parasitoses (incl. zoonoses).
- Diagnostics and molecular epidemiological studies of tuberculosis, paratuberculosis and mycobacteriosis in animals.
- Macroscopic (autopsies) and microscopic investigations (cytology, haematology, histopathology) of animal pathologies.
- Ultrastructural studies of cells, tissues, and organs.
- Immunohistochemical and electronmicroscopic studies of tissues.
- Assessment of animal health and welfare risks associated with keeping/housing conditions.
- Provision of refresher training for veterinarians, farmers, hunters, and other interested persons at the Open University.

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COLLECTION AND TRANSFER OF BOVINE EMBRYOS

Keywords: cattle industry

In vivo developed embryos are collected from valuable donor females to increase the number of offspring and accelerate genetic potential of the population; to change one breed for another and to conserve rare breeds.

- Collection, transfer and/or freezing of embryos from selected females within a herd.
- Transfer of imported frozen embryos.

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IN VITRO PRODUCTION OF BOVINE EMBRYOS

Keywords: cattle industry

The bovine oocytes are collected from live animals or alternatively, from the slaughterhouse. The oocytes are fertilized and cultured up to blastocyst stage, and then transferred or frozen. The method is used for the production of embryos from the desired parents.

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ASSESSMENT OF BULL SEMEN QUALITY

Keywords: cattle industry

Computer assisted sperm motility analysis and flow cytometry are used to assess different sperm motion characteristics, mitochondrial activity and chromatin stability.

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ARTIFICIAL INSEMINATION (AI) COURSE

Keywords: cattle industry

Eighty hours course includes theory and practice of AI, detection of estrus, proper timing of AI, handling of semen, specific features of sexed semen, ultrasound examination of reproductive tract, overview of reproductive disorders, regulation of estrous cycle and many other important practical aspects.

The course is organized by the Open University of EMÜ. Contact person concerning the course content:

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HANDS-ON TRAINING OF EMBRYO-TECHNOLOGY FOR HIGH SCHOOL STUDENTS

Keywords: education

1.5 h hands-on training consists of theoretical introduction to gamete biology, and practical training and demonstrations in order to give knowledge about oocytes, sperm cells, embryos, and embryo technology applications in biomedicine and animal science.

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COUNSELLING ON THE BREEDING OF FARM ANIMALS AND PRESERVATION OF GENETIC RESOURCES, GENETIC ANALYSES

Keywords: cattle breeding

Counselling and training of cattle breeding managers, breeding advisers and workers of breeding organisations with the aim of increasing the productivity of animals and improving the health of cattle in order to increase the profitability of the enterprise and to preserve the genetic resources of farm animals.

Fields of counselling:

- breeding of farm animals;
- preservation of the genetic resources of farm animals.

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GENETIC ANALYSES

Keywords: cattle breeding

At the Laboratory of Genetics of the Institute of Veterinary Medicine and Animal Sciences we genotype animals by using genetic markers for their genetic identification in order to verify parentage and pedigree. Parentage verification is necessary for the purchase and sale of purebred animals, sperm and embryos, for the verification of the identity of twins and for the precision of the genetic evaluation given to male animals on the basis of their offspring. Identification of breeding animals' genetic defects through DNA analyses enables the breeders to avoid, by choosing pairs, the obtaining of recessive homozygote individuals. The elimination of the rams bearing high risk of scrapie PrP-genotypes from breeding will increase the flock's scrapie resistance. Choice based on the hereditary types of milk proteins enables to improve the technological properties of milk.

For the DNA analyses blood, sperm and hair are used.

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PROFESSIONAL LABORATORY MILK PROGESTERONE ASSAY SERVICE AND COUNSELLING

Keywords: milk progesterone, enzyme immunoassay (EIA), cattle, fertility, reproductive performance, reproductive management

Focus groups

- Universities, research institutes and companies

Focus areas

- Research on reproductive function of cattle.
- Reproductive management of cattle (early detection of non-pregnant cows, detection of commencement of luteal activity, detection of abnormal oestrous cycles, measuring efficiency and accuracy of detection of estrus, identification of inseminations performed at wrong time).

Counselling. We give advice on interpretation of results and how to best use milk progesterone analysis for the fertility management of cattle.

Method. Milk progesterone is analyzed by using a monoclonal antibody based quantitative enzyme immunoassay (EIA). The advantage of the EIA is that the changing of milk fat concentrations does not affect assay results, thus allowing precise analysis of progesterone from milk samples with different milk-fat concentrations. The EIA is internationally recognized as a gold standard and a research tool in studying reproductive function in dairy, beef and Tanzanian zebu cattle.

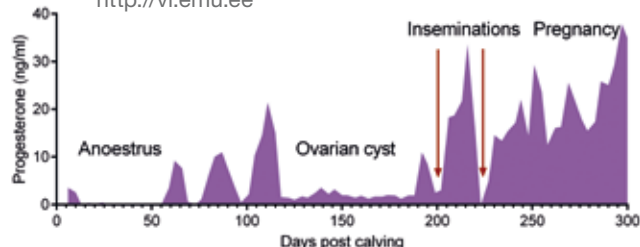
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CHEMICAL ANALYSIS, NUTRITIVE VALUE AND FEED QUALITY EVALUATION

Keywords: animal husbandry, feed production

Analysis of the chemical composition of feed (including fermentation parameters, mycotoxins and amino acids), feed nutritive value and quality evaluation.

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BIOCHEMICAL BLOOD COMPOSITION

Keywords: animal husbandry

Biochemical analysis of blood composition.

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RAW MILK QUALITY ASSESSMENT

Keywords: dairy cow management, dairy product production

Raw milk chemical composition and coagulation properties.

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ADVICE AND TRAINING IN ANIMAL NUTRITION

Keywords: animal husbandry, dairy herd management

- Farm animal nutrition advice, including ruminant feeding and metabolism and relationships with milk composition and yields.
- Ration formulation for the dairy herd.
- Design and execution of feeding experiments including those involving feed additives and novel feeds.

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COUNSELLING AND IN-SERVICE COURSES IN FISH AND CRAYFISH FARMING

Keywords: fish and crayfish farming

The aim of the consultations and in-service courses is to give an overview of the principal knowledge about fish and crayfish farming in Estonia, comprising the current status of the aquaculture sector together with trends and features of its development.

Target groups here include the fish and crayfish farmers and the representatives of various administrations in the field or related to aquaculture area.

Counselling and in-service courses:

- Water as a living environment for fish.
- Fish biology.
- Aquaculture technology.
- Fish farming in Estonia.
- Ornamental fish farming.
- Biosecurity in Aquaculture.
- Crayfish farming and management.

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ICHTHYOPATHOLOGICAL INVESTIGATION, COUNSELLING AND TRAINING ON FISH HEALTH

Keywords: fish farming, fisheries and hydrobiology, fish stocks and environmental monitoring

Counselling and training of veterinarians, fish farmers and environmental specialists with a view to reduce the health risks of the wild caught and farmed fish as well as to increase the production efficiency and competitiveness in aquaculture.

- Ichthyopathological investigations and fish health examinations.
- Wild or farmed fish parasitological examinations.
- Counselling and training of veterinarians and fish farmers.
- Expert analysis to identify possible causes of the death of fish.

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Chair of Aquaculture
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FOOD TECHNOLOGY

Keywords: food processing and technology

Laboratory and counselling services:

- The effect of technological methods and regimes on the composition of dairy, meat, bakery, confectionery and beverage products.
- Product development experiments at food technology laboratories.
- Scientific and applied research.
- Chemical, microbiological, organoleptic and structural analysis of food products.

Trainings, in-service courses, and hands-on trainings for professionals, high schoolers, and other interested parties:

- Technology of meat and meat products.
- Technology of milk and dairy products.
- Technology of bakery and confectionery products
- Meat and milk processing equipment.
- Food microbiology.
- Food packaging.
- Sensory assessment of food.

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FOOD HYGIENE AND VETERINARY PUBLIC HEALTH

- Food analysis using different chromatographic (LC-Q-TOF-MS, LC-MS/MS) spectrophotometric/fluorometric methods.
- Expert opinions and risk assessments in food hygiene and safety.
- Consultation services in food microbiology and food toxicology.

Training courses:

- Food hygiene and safety, basic course.
- Food hygiene, mid-level course.
- Food hygiene and self-control in small-scale and private establishments.
- Food production hygiene and sanitation management.
- Establishing of self-control systems and auditing.
- Prerequisite programs and food safety management systems.
- Control of food allergens.
- Animal protection legislation and its implementation.
- Sanitary and hygiene course for hunters.
- Meat hygiene and inspection.
- The safety of meat and meat products and production hygiene.
- The safety of fish and fish products and production hygiene.
- Determination of food shelf-life and carrying out of the durability studies.
- Food chemical safety.

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ANIMAL CLINIC

Diagnostics and treatment

The animal clinic offers priced veterinary service for the diagnostics and treatment of farm animals, horses and small animals.

The animal clinic has modern facilities for the diagnostics and treatment of animal diseases both on individual and herd level.

For further information please see:

<http://loomakliinik.emu.ee/en>

EQUINE CLINIC

Mon–Fri 8.00–16.00

Phone: +372 731 3713

Outside working hours, call our 24-hour stand-by emergency service: +372 52 22 062

LIVESTOCK CLINIC

Mon–Fri 8.00–16.00

Phone: +372 731 3713, +372 52 57 973

SMALL ANIMAL CLINIC

Mon–Sun 9.00–20.00

Outside working hours on Mon–Sun 20.00–9.00

Phone: +372 731 3224, +372 50 33 878

DEPARTMENT OF EXPERIMENTAL ANIMALS

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Helena Randoja

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<http://loomakliinik.emu.ee/en>

TRAINING

The University of Life Sciences offer regular training on animal health and treatment both for veterinarians and farmers.

For the schedule of trainings please see the webpage of the Open University:

<http://avatudylikool.emu.ee/taiendope>

Aleksandr Semjonov

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PLANNING OF RENEWABLE ENERGY APPLIANCES

Keywords: microgeneration of electricity, distributed generation

Planning of small energy generation solutions according to specific consumption pattern, natural conditions and perspectives.

Distributed energy solutions based on wind, solar, bioenergy or fossil energy sources can be autonomous or connected to the utility grid. The key factor in the work of these systems is the ability to use the energy produced on-site directly by the consumer. This enables to save on electricity grid fees or reduce the need for batteries, dependent on the fact whether it is an on-grid or off-grid setup. Devices tailored to the specific location and consumer needs enable to increase the economic performance.

Additional information:

<http://energiaklass.emu.ee>

<http://energia.emu.ee>

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E-mail: alo.allik@emu.ee

Chair of Energy Application Engineering

<http://te.emu.ee/en>



ENERGY CONSUMPTION AND POWER QUALITY MEASUREMENTS AND ANALYSES

On-site measurements of electricity consumption and power quality parameters. Analysis of the measurement data on statistical basis and on the basis of standards, as well as analysis of electricity consumption over longer time periods if there is access to remote metering data.

The service can be connected to the planning of renewable energy appliances.

Additional information:

<http://energiaklass.emu.ee>

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BIOFUELS

Keywords: bioeconomy, bioenergy, biomass conversion, biofuels

Consultations:

- 2nd generation bioethanol production;
- 3rd generation biodiesel and bioethanol production.

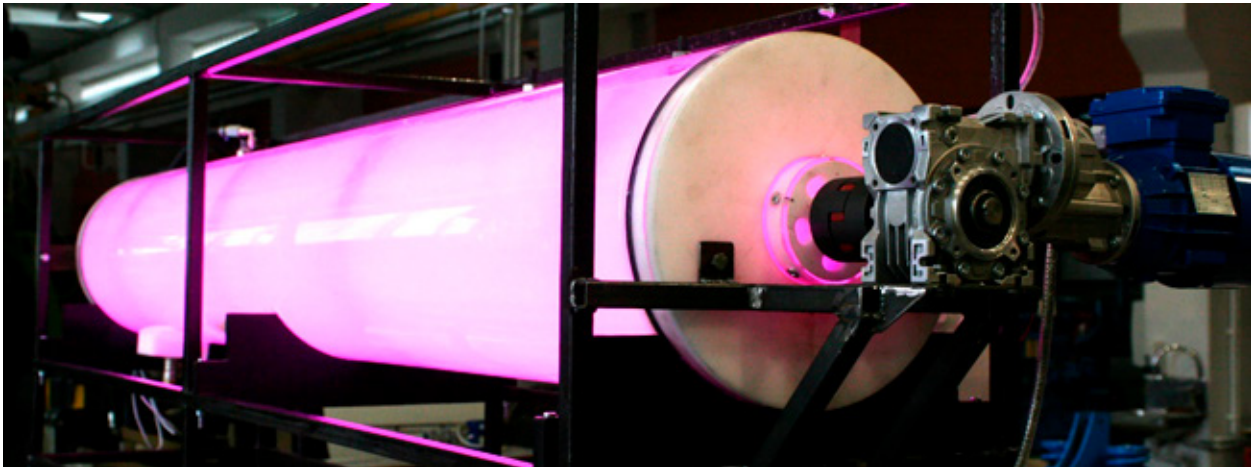
Biofuel analysis:

Analysis of biomass composition - determination of cellulose, hemicellulose, lignin, ash and moisture contents of various biomass.

Analysis of liquid fuels:

Fuels Laboratory of Institute of Technology analyses and evaluates the physical and chemical characteristics of fuels for both: diesel and spark ignition engines. In the Fuels Laboratory, we can analyse different liquid fuels and evaluate their agreement with the standards of European Union.

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TOURISM SOCIAL CARRYING CAPACITY RESEARCH

Keywords: impact, local community, tourism, tolerance, planning decisions, recommendations

Uncontrolled tourism development could lead to dissatisfaction and conflicts at tourism destinations. For avoiding that kind of situations the well-grounded planning decisions should be made, for example zoning of the areas, scatter the tourism flow, diversificate supply, set limitations etc. For reasoned decisions the opinion of local inhabitants about preparedness to support the development of tourism or needs for limitations and other aspects should be studied. Qualitative data would be gathered and analysed for assessment of social impact of visitors to the tourism destination and would be compared with other areas.

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TOURISTS' TIME-SPACE BEHAVIOUR

Keywords: tourism, trajectory, gates, congregating, measures

For planning of tourism objects and for successful functioning of tourism structures there is need to design and map the trajectory of visitors and where and for how long they stop for observations of the objects. The study is designed to avoid congregatings, queues and other contraries and rise the satisfaction of tourists. Trajectories and times would be registered for different target groups. This helps to implement measures for rising visitors' memorable experience and for better management of tourism flows.

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PLANNING NATURE BASED TOURISM

Keywords: nature based tourism, objects in nature, routes, services, information, recommendations, planning

Nature tourism and use of natural resources for tourism purposes is increasingly growing and recommended in Estonia. Trails, single objects of interest on private and state lands, different activities related to observing nature or picking activities are the main possibilities in our country. How to develop a route or trail in my lands or region? What, how and whom I should offer? How should I start and whom should I agree? What kind of activities I could do and how to prepare and implement? How to make information materials and install them? These practical questions get answered during the planning process.

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NATURE BASED TOURISM OBJECTS MAPPING AND MONITORING

Keywords: nature based tourism, tourism object, mapping, monitoring, planning, resources

Detailed overview of resources and continuous monitoring is needed for successful nature based tourism development. For planning decisions it is important to understand links between customer journey and nature tourism objects and also assess how existing and planned infrastructure fits to customer expectations. It is really important because there is continuous rise in visitor numbers in nature areas and tourism sector is constantly changing.

Example activities what is needed for tourism planning and development:

1. mapping and monitoring objects and infrastructure needed for nature based tourism development,
2. analysing and monitoring quality and condition of nature based tourism objects and infrastructure,
3. assessing how nature based tourism objects and infrastructure fits to the needs of different target groups and locates in the context of customer journey,
4. analysing suitability and influences between infrastructure and surrounding environment;
5. assessing nature based objects carrying capacity,
6. assessing nature tourism objects tourism value.

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BOTANICAL EXPERTISE AND TRAINING IN NATURE PROTECTION

Keywords: expertise and training in nature protection, municipalities, nature protection institutions, land owners, tourism companies, real estate developers

Expertise and training

- Management and restoration of seminatural grasslands;
- identification of protected plant species, management of the communities necessary for their conservation, their translocation;
- nature tourism and nature education.

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MYCOLOGICAL CONSULTATIONS AND TRAINING

Keywords: educational institutions and enthusiasts

- Identification of fungal species with information about their ecology, use and possible toxicity/harmfulness.
- Seasonal exhibitions (identification of fungal species, professional consultations for public).
- Fungal foray guidance - teaching fungal diversity in the forest.

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EXPERTISE OFFERED BY ORNITHOLOGICAL UNIT

- Species action and management plans, population status evaluation.
- Management plans of conservation and protection areas.
- Expert assessments on nature conservation and environmental protection.
- Management and monitoring of zoological inventories.
- Research on animal movement and migration, including radar studies and telemetry.
- Conservational molecular genetics expert assessments and the elaboration of conservation management plans based on the results.
- Digitization and analysis of biodiversity data.
- Courses and practical instruction of bird identification and bird survey techniques.

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ENTOMOLOGICAL EXPERTISE

Keywords: consultation and training

- Evaluation of damage caused by insects: correlated studies, prognoses and possible solutions.
- Consultation for amateur entomologists including theoretical courses and practical training.
- Identification of insects' species supplemented by outlining and discussing their distribution and biology.
- Founding of a biological collection: care, necessary documentation and digitization.

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INLAND WATERBODIES - PROTECTION AND MANAGEMENT

Keywords: Ministry of the Environment, Environmental Board, municipalities, nature protection institutions, fish breeders, fishery institutions, developers of waterbodies

- Assessment of the ecological and environmental status of waterbodies.
- Sanitation of lakes.
- Sanitation of watercourses.
- Compilation of management plans, expert opinion.
- Analysis of the functioning disorders of waterbodies.
- Ecological toxicology of waterbodies.
- Assessment of the fish stocks of inland waterbodies and suggestions for their optimum management.
- Assessment of the condition of waterbodies.
- Assessment of the biological resources of waterbodies and suggestions for their exploitation.

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Centre for Limnology

<http://pk.emu.ee/en>



ADVICE AND CONSULTANCY AREAS FOR CHAIR OF LANDSCAPE ARCHITECTURE

The target group: municipalities, administration of nature protection areas, park owners and managers, ministries, RMK and private forest owners, state institutions or foundations and private companies.

ACCESSIBILITY AUDIT OF RECREATION AREAS AND URBAN PUBLIC SPACE

Keywords: accessibility audit, forests, parks, protected landscapes, universal design, access by people with disabilities

Many public spaces, ranging from urban parks to forests have problems of accessibility to people with a range of disabilities or impairments. We have expertise in this area.

Services include:

- Survey and assess accessibility for different groups in different areas or landscape types
- Test the sustainability of public spaces
- Offer planning and design advice based on the outcome of the surveys

URBAN GREEN INFRASTRUCTURE SURVEY, ASSESSMENT AND PLANNING

Following our extensive research in urban green space (including public and private urban green elements) management and using specialised equipment and resources we can offer:

- Survey and assess green areas such as parks, urban forests, avenues and streets
- Map and inventory of green areas in GIS
- Assess the health and management condition of urban trees
- Advice on sustainable management of urban green areas
- Advice on ecosystem services and benefits of urban green

LANDSCAPE AND VISUAL IMPACT ASSESSMENT (LVIA) USING THE VIRTUAL LANDSCAPE THEATRE

Both common and exemplary landscapes, that we inhabit create the background structure for our activities and form a part of everyone's identity. This is why large portion of people care very deeply about visual appearance of new objects and their impact on the functioning of the landscape. This is especially applicable in case of:

- a. renewable energy projects,
- b. planning of new roads and traffic structures
- c. larger projects in protected areas.

Interactive landscape theatre makes it possible to create expansive virtual landscapes from actual map data and explore such models in real time from any viewpoint. This makes it possible to determine visibility/occlusion of the new landscape element and explore its spatial proportions and relation to other landscape elements. Up to 15 people can be immersed in the virtual landscape at once and take part in workgroup discussions of sketches; assess the visual and landscape impact; take active part in participatory planning process.

ADVICE ON LANDFORM AND PLANT-COVER DESIGN AND RECULTIVATION OF MINING AREAS AND QUARRIES

In Estonia there are many areas affected by mining (oil shale) and quarrying (sand/gravel and stone) and other disturbance (landfill) which need either to be restored or planned and designed with an end use in mind. We can offer the following:

- Advice on the design of landforms including water bodies for new projects and for restoration of old workings
- Prepare models and visualisations of the future landscape after the completion of a project
- Advise on after use and recultivation/vegetation restoration, and management

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LANDSCAPE CHARACTER ASSESSMENT (IN ACCORDANCE WITH THE PRINCIPLES OF THE EUROPEAN LANDSCAPE CONVENTION (ELC))

- a. for municipalities, who value the landscape character
- b. for landscape protection areas

Landscape character assessment is a main starting point for implementing the ELC and we have many years of experience in this. We can offer:

- Mapping and inventory of landscape types at different spatial scales
- Field survey and assessment
- Preparation of reports describing landscape character

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<http://pk.emu.ee/en/structure/landscapearchitecture>

SUSTAINABLE URBAN WATER SYSTEM PLANNING AND DESIGN

Our focus is on demand-led research to develop sustainable, robust and flexible solutions targeting new developments and retrofit SUDs into existing developed areas using an integrated and transdisciplinary approach. Following our experience with sustainable urban water systems' (SUDS) planning and design, we can offer advice on Integrated stormwater management (ISWM) and sustainable urban water system (SUDs) planning and design for residential areas, public campuses, highways and roads etc.

We offer:

- Survey and needs assessment for SUDs and integrated stormwater management techniques and tools and their application at different urban scale.
- Learning alliances, workshops and best practice guidance

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Chair of Landscape Architecture
<http://pk.emu.ee/en/structure/landscapearchitecture>

ADVICE FOR FOREST PLANNING AND DESIGN WHERE VISUAL AND AESTHETIC ASPECTS HAVE TO BE TAKEN INTO ACCOUNT

Designing clear cut areas of the production forests is becoming part of common practice in Finland, UK and elsewhere. Based on experience of mentioned countries and relying on Estonian forest landscape peculiarities, we can offer consultation to:

- Design for single clear cut areas
- Prepare forest landscape plan for larger forest areas
- Design for roadside and other exposed forests

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RECREATION AREA PLANNING AND DESIGN AT A STRATEGIC OR SITE DESIGN SCALE

As outdoor recreation and various forms of tourism expand and develop there is a greater need for planning and design at different spatial scales. We can offer:

- Planning of recreation and tourism at a large territorial scale (such as a national park, landscape protection area, RMK recreation area or country)
- Assess sensitivity and capacity for recreation and tourism development
- Prepare advice on planning, design and management of recreation and tourism infrastructure

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PLANNING AND DESIGN OF HEALING GARDENS AND HEALTH TRAILS

The relationship between landscape and health is a growing area of research and practice. We have built up special expertise in a number of areas related to this and can offer the following services:

- Landscape design using Evidence Based Design principles
- Expert assessment of a landscape for healing gardens
- Education in Healing landscapes
- Education in Garden therapy
- Garden therapy programmes for people with special needs
- Consultation of the same topics for private landowners
- Hospital green area design, assessment and garden therapy programs by departments
- Green area analyses by different area usergroups

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ADVICE ON THE PROTECTION AND MAINTENANCE OF LANDSCAPES OF CULTURAL HERITAGE

Cemeteries, historic urban or rural parks and gardens, railway station parks, school gardens and parks, etc.

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ADVICE ON THE ASSESSMENT OF REMAINS OF SOVIET CULTURAL LANDSCAPES

The major part of the Estonian cultural landscape is developing on the basis of soviet collective agriculture, with its built remains and settlement patterns. We can offer the following:

- Advice on the assessment methods for these landscape and settlement types
- Consulting on suggested development or protection schemes

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MAINTENANCE PLAN FOR HISTORICAL PARKS UNDER NATURE PROTECTION AND CULTURAL HERITAGE

Liina Jürisoo

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URBAN RESILIENCE, HEALTH AND WELL-BEING, ECOSYSTEMS SERVICES, SUSTAINABLE URBAN PLANNING

Himansu Sekhar Mishra

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PREPARATION AND MONITORING OF DEVELOPMENT PLANS AND STRATEGIES

Keywords: rural enterprises and entrepreneurs, consultants, municipalities, local action groups, professional organizations, public sector, development, analysis, training

The drafting of development plan supports planning of the development of the enterprise, organization or institution. The service provides an analysis of the object or the domain (overview on the regulatory legislation, documentation and socioeconomic situation, and SWOT analysis and problem analysis), and the mapping of strategic choices (creation of vision, mission statements, defining and choosing of strategic goals, formulation of strategy, formulation of fields of activities, preparation of action plan, creation of system of development indicators).

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Department of Rural Economy Research
<http://ms.emu.ee/en>

STRATEGIC DEVELOPMENT OF ENTERPRISES

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, analysis, consultation, training

Options in making strategic decisions in enterprises. Description of different processes, mapping and analysis of managerial decisions (incl. use of resources, investments, financing and availability of supports) and their impact of the economic indicators of the enterprise (outcome indicators). Analysis of the diversification possibilities of enterprises' activities; risk and hazard assessments. Compilation and evaluation of business plans.

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CONSULTATIONS ON COOPERATION AND COOPERATIVES

Keywords: rural enterprises and entrepreneurs; cooperatives, development organisations, consultants, municipalities, professional organizations, public sector, development, consultation, training

Preparation of action plans for establishing cooperatives and/or cooperation project by implementing the principles of brainstorming. Formulation of the goals of the cooperative and/or cooperation project; planning of the structure and the management of the cooperative. Composition of the capital of the cooperative and implementing democratic control over its use. Estonian legislation on cooperatives and success stories of Estonian cooperatives.

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PRODUCTIVITY AND EFFICIENCY ANALYSES

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, development, analysis, training

Attention is focused on the importance of productivity (total and partial productivity) indicators; on the calculation and interpretation of the indicators; and on finding alternatives to increase productivity. Analysis of the connections between enterprises' productivity and efficiency. Analysis of opportunities for increasing (technical and economic) efficiency.

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COMPETITIVE ABILITY AND MARKET ANALYSIS

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, development, analysis, training

Compilation of necessary information for the enterprise and its analysis on the basis of evaluation of competitive ability, compilation of market information and data on product marketing. The use of competitive ability indicators in directing the economic activities of the enterprise and in improving its economic performance. Compilation of data on competitive ability indicators and their analysis to assess the local and international competitive ability. Evaluation of the enterprise's/sector's competitiveness and benchmarking.

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SMALL BUSINESS MARKETING

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, preparation of marketing plan, analysis, consultation, training

The peculiarities of small businesses through marketing mix (product development, pricing tactics and strategy, marketing communication methods). Small businesses' decisions on marketing channels and short distribution channels (individual and cooperative). Possible branding systems for small business (from individual to national) and public relations. Planning of marketing. Marketing in Internet.

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GREEN ECONOMY AND ENTERPRISE SUSTAINABILITY

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, consultation, training

The analysis of the impact of implementation of environmentally friendly technologies on the economic performance of the enterprise, and the possible alternatives. The assessment of environmental impacts with production life cycle analysis (LCA).

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ESTABLISHMENT OF ACCOUNTING SYSTEM FOR NEW ENTERPRISE

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, consultation, training

Accounting legislation. Preparation of enterprise's accounting manual. Organization of enterprise's financial account (incl. accounting of biological assets) and managerial accounting. Preparation of enterprise's annual report and evaluation of enterprise's financial situation.

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Department of Accounting and Finance

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REGIONAL DEVELOPMENT AND ANALYSIS OF REGIONAL COMPETITIVENESS

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, development, analysis, training

Evaluation and analysis of competitiveness of rural areas (rural municipality, village, town) on the basis of their situation. The assessment is formed on the basis of the comparison of specific indicators (social capital, entrepreneurial activity, income etc) and of additional regional indicators formulated for the analysis.

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RURAL SOCIOLOGICAL RESEARCH AND ANALYSIS

Keywords: rural enterprises and entrepreneurs; consultants, municipalities, professional organizations, public sector, analysis, consultation, training

Preparation of the research question and research methods (qualitative or quantitative), choice of survey method, sampling (choice of target group, preparation of sample, sampling methods, choice of sample size and distribution); preparation of questionnaire; conducting the survey, data entry, data analysis, reporting.

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TESTING OF BUILDING MATERIALS

Key words: timber, steel, concrete, fibre reinforced concrete (FRC), glass fiber reinforced polymers (GFRP)

- Physical-mechanical properties of construction materials: compression, bending, torsion, tensile strength etc
- Shrinkage of concrete and fibre reinforced concrete
- Strength and stiffness of fibre concrete
- Bonding strength of GFRP

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TESTING OF BUILDING STRUCTURES AND STRUCTURAL ELEMENTS ON OBJECTS AND IN LABORATORY

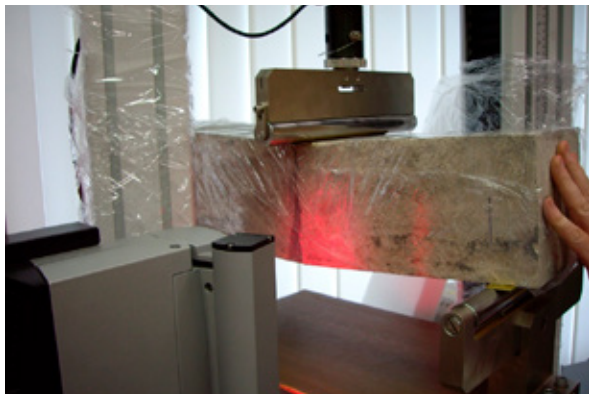
Key words: load bearing capacity, deformations, testing of new and existing structures

- Reinforced concrete beams, columns, panels
- Timber beams, columns, trusses
- Steel beams, columns
- Composite beams, columns, panels

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Determination of flexural toughness of FRC



Testing of timber-steel-concrete composite panel



DETERMINATION OF RESIDUAL STRESSES IN COATINGS AND DETAILS

Key words: construction, mechanical engineering, residual stresses

- Galvanic, powder-, plasma-, PVD-, CVD- coatings
- Residual stresses in the surface layer of details by hole-drilling method

Alexander Ryabchikov

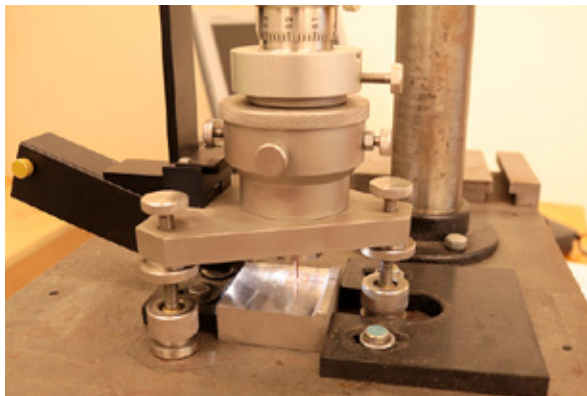
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<http://mi.emu.ee/en>

Determination of residual stresses in the surface layer of detail by hole-drilling method



SPACE PLANNING AND CONSTRUCTIVE SOLUTIONS OF AGRICULTURAL BUILDINGS

Key words: agricultural and industrial buildings

- Designing of agricultural buildings and facilities according to the planned technologies and in a view of typology
- Designing of constructive solutions along with strength and stability calculations
- Solutions for new and existing constructions

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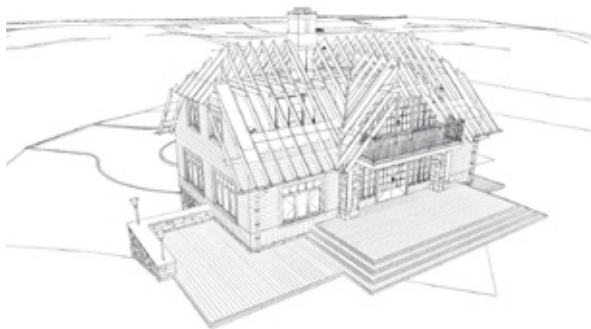
SPACE PLANNING AND STRUCTURAL SOLUTIONS OF RESIDENTIAL BUILDINGS

Key word: designing

- Architectural and structural solutions
- Detail planning and calculations for energy performance certificate

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INVESTIGATIONS OF NATURAL BUILDING MATERIALS IN CONSTRUCTION

Keyword: natural building materials, (timber, clay, lime, straw, reed, hemp, flax, sawdust), hygrothermal properties and behaviour of materials

- Consulting service on general properties and application techniques of natural building materials (incl. natural finishing materials)
- Physical-mechanical properties of natural building materials
- Hygrothermal properties of natural insulation materials in laboratory conditions and in situ

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INVESTIGATION OF BUILDING PHYSICS PROPERTIES OF BUILDING ENVELOPES AND MATERIALS, INNER CLIMATE, CONSULTATIONS

Keywords: building physics, building envelopes and materials, inner climate, in situ studies

- Hygrothermal state of building envelopes (Blower Door, thermography, hygrothermal performance and etc)
- Thermal conductivity and other properties of materials
- Inner climate (temperature, relative humidity and CO₂ content, air movement)

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Measurements in test house



CONDITION ASSESSMENT OF SUBSOILS AND FOUNDATION STRUCTURES

Key words: foundations, settlements, design

- Assessment of bearing capacity of subsoil and foundations, settlements of foundations, dynamics monitoring, stability of foundations
- Designing of foundations solutions taking into account geological and hydrogeological conditions

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Timber foundations in old Tartu



ASSESSMENT OF TECHNICAL SITUATION OF BUILDINGS AND STRUCTURES

Key word: technical situation of building, thermography, stress wave timing, moisture content, resistance micro-drilling

- Assessment of building and structures
- Assessment of structures in non-destructive methods
- Consulting service on special conditions of buildings under national heritage protection

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NOTE: All available experimental scientific services are NOT certified.

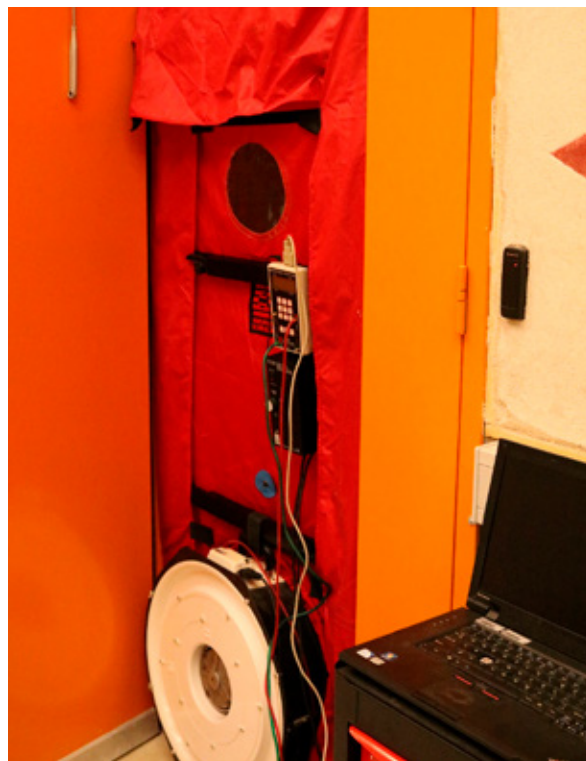
Structures laboratory



Non-destructive assessment of timber stucture



Blower Door test



TESTING OF MILKING MACHINES

Keywords: agriculture, animal husbandry, dairy farming

The technical condition and performance of milking machines is evaluated with modern measurement systems.

Measurement data characterise:

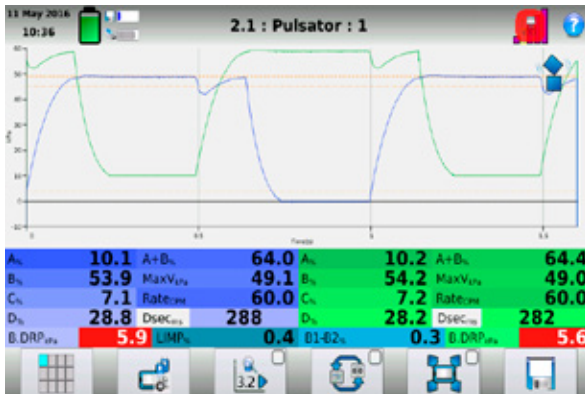
- the performance of the vacuum pump;
- vacuum loss in milk and vacuum pipeline;
- vacuum stability in the milking machine;
- accuracy of the milking machine pulsation.

On the basis of the measurement data it is possible to:

- decide whether the milking machine or some of its parts should be repaired or replaced;
- discover the causes of milk quality and udder health declination.

The duration of the entire test is about two hours. It is possible to test milking machines during regular milking.

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DESIGN OF ANIMAL-FRIENDLY AND ECO-FRIENDLY CATTLE FARMS

Keywords: agriculture, animal husbandry, dairy farming

Counselling of dairy farmers on domestic and foreign customs, experiences and standards when renovating an existing or building a new farm.

Experts will help to:

- select a housing system;
- draft flow processes of milking, feeding, watering, manure removal etc;
- select machines, equipment and farm installations;
- design farm layout.

The prepared technological design serves as an input for building design documentation or it can be used to justify a business plan.

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ASSESSMENT OF WORKERS' ENERGETIC LOAD

Keywords: workplaces, production lines and work environment of agricultural or industrial enterprises

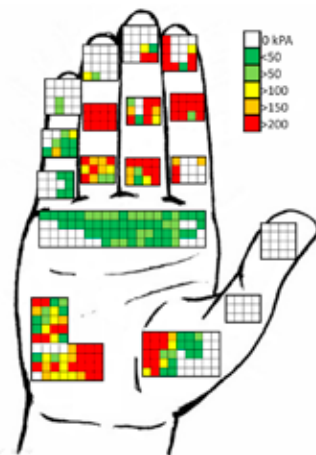
The impact of work environment on the energetic load of workers is determined by heart rate measurements.

Assessment of workers' energetic load enables to:

- determine the severity of work strain;
- compare the workloads of machines and systems;
- determine the work postures and movements with the highest energetic load;
- reduce the harmful effect of workload.

The heart rate monitor consists of a chest strap transmitter and a wrist receiver. Data processing allows to determine the oxygen and energy consumption of workers and to classify the severity of work strain in accordance with WHO approved classification.

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CHOOSING AN ERGONOMIC TOOL

Keywords: activities involving hand tools

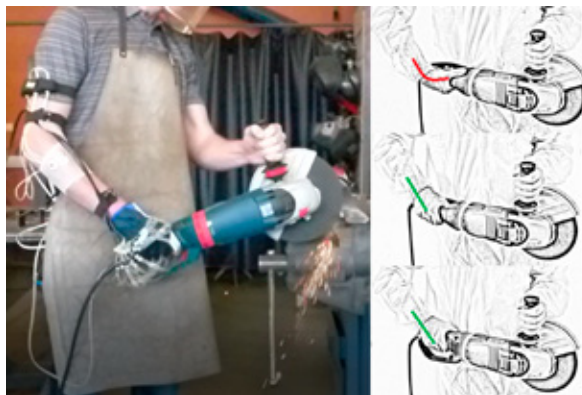
The aim of the counselling is to find the most user-friendly solutions among a number of tools in order to enhance productivity and reduce the risk of work induced disorders.

Counselling:

- specification and explanation of ergonomic criteria;
- compliance assessment;
- addressing individual comfort issues by objective (pressure mapping) and subjective methods.

The counselling includes the capacity assessment of workers muscular strength, endurance and range of motion. During the compliance assessment the contact area and pressure distribution of hand-handle interface and bioelectrical activity of muscles is measured.

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DETERMINATION OF GAS COMPOSITION OF AIR

Keywords: agricultural or industrial enterprises, boiler houses, storages, repositories

Relative humidity, temperature and concentrations of O_2 , CO_2 , NH_3 are measured with appropriate sensors.

Determination of the gas composition of the air enables:

- real-time monitoring of microclimate parameters and their alterations;
- designing a safe work environment.

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MECHANICAL TESTING OF MATERIALS AND METALLOGRAPHY

Keywords: product development, machine building, mechanical properties, material structure

Consultations:

- choosing materials on basis of the strength of the structure;
- measuring hardness (Brinell, Rockwell, Vickers);
- tensile tests, compression tests and flexure tests;
- preparing micro- and macrosections;
- metallography.

Test materials can be metals and metal alloys, plastics, wood etc.

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QUALITY CONTROL OF PARTS

Keywords: product development, machine building, technical measurements, technical drawings

Consultations:

- measuring machine elements with 3D coordinate measuring machine;
- measuring machine elements with portable 3D laser scanner;
- measuring geometrical tolerances;
- tolerances and fits;
- surface roughness determination;
- dimension chains calculation.

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PROTOTYPING

Keywords: product development, engineering, machine building

Consultations:

- engineering calculations;
- designing machineries and metal structures;
- 3D-modeling and reverse engineering;
- 3D printing.

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HEAT TREATMENT OF MATERIALS

Keywords: mechanical engineering

Consultations:

- heat treatment processes;
- heat treatment service.

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TECHICAL MEASUREMENTS

Keywords: machinery engineering, product development, engineering drawings

Consultations:

- tolerances and fits;
- surface roughness determination;
- dimension chains calculation.

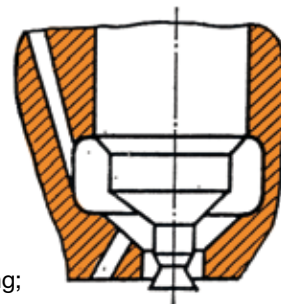
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RECIPROCATING ENGINE TESTING

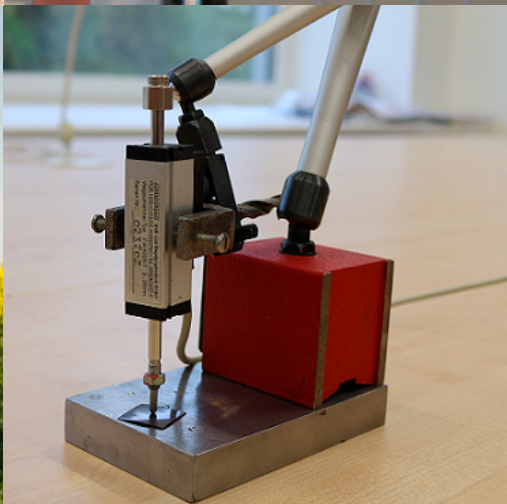
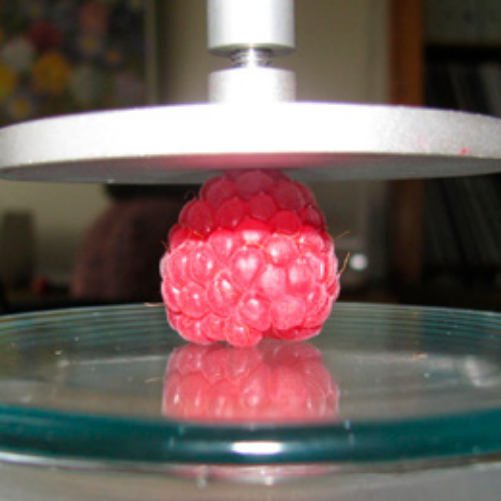
Keywords: engine diagnostics, engine tuning

Consultation:

- reciprocating engine testing;
- reciprocating engine tuning;
- reciprocating engine sensors' diagnostics;
- diesel feed systems' diagnostics;
- engine sub-systems' development.



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